

On the Dangers of Stochastic Parrots: Can Language Models Be Too Big?

1. What did the authors do (what kind of implementations, what kind of experiments, what kind of studies, dataset creation, etc.)? Are there logistical lessons I can take away for my own work?

The authors in this research paper took a step back and asked how big the Language Models (LMs) are? Are those LMs too big? Are there possible risks associated with such a technology? Are there ways available for mitigating those risks? The authors provided a few recommendations, such as weighing the environmental, financial costs first, investing resources into curating and carefully documenting datasets rather than ingesting everything on the web, carrying out pre-development exercises evaluating how the planned approach fits into research and development goals, and supporting stakeholder values, and encouraging research directions beyond ever-larger language models. The authors highlighted that training large AI models (i.e., LMs) consumes a lot of computers processing power, resulting in consuming a lot of electricity, where they referred to a 2019 paper from Strubell et al., *Energy and Policy Considerations for Deep Learning in NLP*, on large LMs's carbon emissions and financial costs of large LMs, finding that their energy consumption and carbon footprint have been exploding since 2017, where more models have been fed more and more data. Strubell et al. found that training one LM with a particular *Neural Architecture Search* (NAS) method would have generated the equivalent of 626,155 pounds (284 metric tons) of carbon dioxide (CO₂), which equals a lifetime output of five average American cars. Shockingly, training one version of Google's LM, BERT, which backs the company's search engine, produced 1,438 pounds of CO₂ equivalent according to Strubell et al. estimate, which is nearly the same as a round-trip flight between NYC and San Francisco. These numbers should be viewed as minimums since it is just the cost of training only one model, one-time through. In practice, many models are trained and retrained many times over and over during research and development. The authors here in this paper pointed out that the sheer resources needed to build and sustain such big AI models mean they tend to benefit wealthy organizations. At the same time, climate change hits marginalized communities hardest; they stated, and I quote, "*It is past time for researchers to prioritize energy efficiency and cost to reduce negative environmental impact and inequitable access to resources — both of which disproportionately affect people who are already in marginalized positions.*" The authors also advised the researchers to be careful when using such massive data and mysterious models because those large LMs are trained on exponentially growing text datasets since they sought to collect all the data they could from the internet. Therefore, there is a considerable risk that racist, sexist, and otherwise offensive language will result in the training datasets. Lastly, the authors summarized the third challenge as the risk of "*misdirected research effort*" in the research opportunity costs. However, most AI researchers acknowledged that large LMs do not understand human languages and are merely excellent at manipulating them.

2. Could I have done this work if I had the idea why or why not?

I think I could have done this work if I had the idea first. This research paper aims to spread the awareness of how the rising interest in AI technologies comes with a hefty price (i.e., worsening climate change) and refuting falsehoods about the LMs that actually do not understand human languages and are merely excellent at manipulating it.

3. Is there anything I could do to repeat or validate? Do I understand how the experimental results were generated? (Make notes of materials available from the paper- data sets, source code)

I could do nothing to repeat or validate this research paper because the paper is a systematic review with only one table highlighting an overview of recent large LMs.

4. What is my best idea for follow on work that I could personally do? What is my best idea for follow on work that I'd like to see the authors or others do?

My best idea for follow-on work that I could personally do is to explore the effective ways to document training datasets; of course, this is an essential step since I am leaning toward researching the space of Natural Language Processing (NLP). In this paper, the authors discussed how datasets documentation allows for potential accountability, and the undocumented training datasets perpetuate harm without recourse. Without documentation, one cannot understand training datasets characteristics to mitigate some of these attested issues or even unknown ones.

5. What weaknesses do you see in the paper?

The paper is excellent, and it came out at such a critical timing, where climate change is worsening every day. At the same time, human beings, especially the technology industry, are obsessed with developing bigger and bigger AI models that take us a step closer to the end of the world unless we control them, manage them, and use them effectively in environmentally friendly ways.